



Microbial vodcasting – supplementing laboratory time with vodcasts of key microbial skills

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Abstract: First-year microbiology practical classes can be chaotic environments with more than 30 inexperienced laboratory users in close proximity to microbial cultures and flames from bunsen burners. Whilst Charles Sturt University (CSU) prides itself on giving first year students extensive hands-on experience, time constraints and class size can make it difficult to ensure every student receives adequate individual attention as required for the development of competency in key microbiological skills. To address these issues, we provided an introductory microbiology class (N=277) with short videos demonstrating key microbiological skills. The subject serves eight courses: Clinical Science, Forensic Biotechnology, Health Science (Nutrition and Dietetics), Medical Science, Pharmacy, Science and Animal Science. Further, 29 of the 277 students were distance education students who completed the practical component during a four-day residential school. The vodcasts were designed to give each student access to demonstration of key microbiological skills as performed by a highly-skilled individual. Towards the end of the semester, a survey was administered to all students to gauge their use of the vodcasts and their perceptions of how the vodcasts assisted their development of skills or understanding of key concepts. This paper describes the process of developing and delivering the vodcasts and provides an evaluation of their suitability as identified by their consumers, the students.

Introduction

The higher education sector has undergone many changes in recent years, particularly with web-based technologies being passionately espoused by some educators. The advent of innovative and powerful new technologies, such as podcasts, wikis, blogs, videohosting (e.g. *YouTube*), and course management software, such as *Sakai* and *Blackboard*, has eased and quickened delivery of learning materials to students, often augmenting the learning experience. Educators in the science disciplines, who frequently rely on demonstrations (Thompson 1972), are beginning to adopt new learning technologies (Brown 2006) to promote better understanding of subject materials. Web-based technologies, such as podcasts and wikis, are increasingly being incorporated into traditional learning environments (Boulos, Maramba and Wheeler 2006; Copley 2007), particularly in the delivery of distance education (Beldarrain 2006). The main advantage of using these methods is that subject material can be equally accessed by students regardless of whether the delivery mode is distance or internal, thus disadvantaging neither group.

The use of video to demonstrate key concepts and skills has been common place in many University and Secondary School laboratories for many years, albeit without in depth investigation of their utility as effective learning aids. Videodiscs and videos are used to demonstrate a variety of techniques in science-related fields such as physiology, dentistry and medicine. For example, educators have successfully used video-based training to help students acquire better practical skills in animal dissection techniques and human surgery (Kinzie, Strauss and Foss 1993; Hammond, Taylor and McMenamin 2003). Research on the didactic benefits of this technology show students develop more confidence and competence following video-based training, and demonstrate a higher level of skill when performing these techniques, than students who have not been exposed to video-based training (Hammond, Taylor and McMenamin 2003; Kinzie, Strauss and Foss 1993). Microbiology, like many of the science is one of the areas that beginning to utilise the video housing and delivery capabilities of the web as a means of delivering concepts and content to the new generation of learners (Cann 2008). Student's have access to microbial content from a variety of sources including the informal such as *YouTube* and the formal, such as, textbook publishers web sites, *itunesU* and University sites (Copley 2007). However, apart from a trial investigating general non-mechanical skill-based microbiology competencies in a Spanish pharmacy course, where students were taught microbiology using a blended-learning approach with virtual laboratories



(Sancho, Corral, Rivas, Gonzalez, Chordi and Tejedor 2006), the potential for microbiological skills development, as opposed to pure conceptual understanding, to be enhancement via technology adoption has not been explored and is thus a focus of this investigation.

Vodcasting (web enabled delivery of videos to designated group) is being trialled in other institutions and disciplines, such as information technology (Sampson, 2006) and the arts (Jetnikoff 2007; Lipscomb 2007). This project is the first to look at the value of vroadcasting in the teaching of microbiology and was undertaken to determine the effectiveness of vroadcasting as a tool to demonstrate key microbiological techniques to first year microbiology students. Vroadcasting entailed supplying short videos over the web to a group of subscribers (enrolled students) who were enrolled in courses such as the Bachelor of Pharmacy, Bachelor of Biotechnology and Bachelor of Medical Sciences. The study was conducted at Charles Sturt University (CSU), which has long been recognised as a provider of quality education to traditional classroom-based and distance education students. Training in basic microbiological skills is an important feature of the subject whereby both internal and distance students must acquire microbiological skills during either 12 weeks of three hour practical classes or during and intense four day residential school, to satisfactorily complete the subject. The vodcasts provided clear and detailed instructions for the performance of microbiological techniques and could be accessed by the students on demand, when needed and as often as needed. All seven vodcasts were available from the first week of semester and remained available throughout the 13 teaching weeks. Hence the vodcasts were able to be used as both pre practical familiarisation tools and for post practical revisions. The students were made aware of the existence of the vodcast but were not told they had to view them at any particular time or at all, viewing was optional. The skills demonstrated in the vodcasts were demonstrated in class and practiced by the students. Further, gram staining skills were assessed as part of a practical examination in Week 10. Finally, use and perception of the vodcasts was evaluated using a survey administered in Week 9 of the 13 week course. Who used the vodcast and when was another key focus of this study as such information has the potential to impact how future applications of the technology are prepared, applied and delivered.

Methods and process

Vodcast production, sampling and surveying

The seven vodcasts were filmed using a *Canon Powershot A85* under standard fluorescent lights with the camera used for both audio and video capture. The demonstrator seen in the vodcasts, and author of the narration, has more than twenty years of microbiology experience in both professional diagnostic and university teaching laboratories. The narrator, one of the lecturers for the subject, was also the camera controller. Once recorded, the vodcast files were converted to 'wmv' format with no other postproduction modifications made. The files were hosted in the resources section of the class *Interact* site, a CSU version of *Sakai*, an educational community open sourced, course management platform. Students were notified of the existence of the vodcasts in internal classes and via an emailed announcement. The skills and concepts demonstrated and their run length and file size were as follows: use of a bunsen burner (1min 44secs, vodcast length, 900k, file size), plate streaking (3mins, 8mb) to obtain single bacterial colonies (16 streak plating), aseptic handling (39secs, 1.7mb) of microbiological samples, aseptic transfer (1min 32secs, 4.1mb) of bacterial cultures from agar slopes to fresh media, general aseptic transfer (1min 43secs, 4.6mb) of bacterial cultures in order to inoculate media, making a smear (1min 54secs, 5.1mb) of a bacterial culture on a slide and Gram staining (2mins 21 secs, 6.3mb) of bacteria.

A 13 question survey, approved by CSU human ethics committee (protocol number 2008/080), was distributed to the internal students (N=248) during practical classes and e-mailed to each of the distance students (N=29) in the ninth week of the semester. The survey explored four key areas:

- 1) demographic details (age, gender, laboratory experience);
- 2) number of vodcasts viewed and location of viewing;
- 3) assessment of skill development and perceived understanding of key concepts; and
- 4) opinion on vodcasts' utility for learning and future organisation / utilisation.

Student assessment and perception of skill development and understanding of key concepts were investigated via closed answered questions (yes, no, did not view) for the four key skills: aseptic technique, preparing a smear, gram staining and 16 streak plating. In regards to the 4 skills the students were asked:

- i. 'Do you think the vodcasts assisted with the development of your skills in any of the following areas?'
- ii. 'Do you think viewing the vodcasts assisted your understanding of key concepts relating to any of the following areas?'

To gauge the student's opinion of the vodcasts they were asked a close ended question, 'What is your overall opinion of vodcastings', with the answer options being:

- i. great, I would like to see it adopted in other courses;
- ii. it was okay but I do not believe it enhanced my learning or skill development anymore then what I would have achieved from the prac classes and lectures alone; and
- iii. it was a waste of my time.

Finally, opinions as to how vodcasts could be utilized in the future were ascertained by asking the close ended question 'How do you think vodcasts could be best utilised?', with four answer options;

- i. as replacements for practical classes;
- ii. to reinforce skills taught in practical classes;
- iii. to provide pre-prac demonstrations of key skills; and
- iv. I cannot see how they could be of any use.

Results

Our survey yielded a 61% response rate (N=169). Findings reveal moderate use of the vodcasts, with 45% of the sample having watched at least one of the seven vodcasts (27% of the entire class). A gender difference was not observed as 53% of the male respondents and 55% of the female respondents watched at least one vodcast. However, vodcast viewing appears to vary according to age since 44% of respondents under 20 (N=132) and 44% of respondents aged 20–25 (N=23) had watched at least one vodcast yet 60% of respondents aged 25–30 (N=5) and 71% of respondents over 30 years old (N=7) had watched at least one vodcast. Also, variation of viewing appears related to level of expertise since students with prior professional laboratory (professional) or university laboratory (university) experience were less likely to watch the vodcasts then those with no laboratory (none) experience or those with only high school laboratory experience (novice) as shown in Table 2.

Table 1. Respondents' level of prior laboratory experience and representation of the levels amongst those who viewed the vodcasts in contrast to that categories degree of representation within the sample

Level of Expertise	% Who watched Vodcasts	% of Total Respondents
None	10	10
Novice	71	73
University	11	67
Professional	7	33



Our survey shows students viewed the vodcasts in a range of locations. The majority of students who viewed the vodcasts accessed them using a non-university network (47%). 19% accessed the vodcasts via both a university and non-university network and 35% only accessed them via the university's network. Access using the university's network included computers based in libraries, computer labs, campus wireless points and personal computers located in student accommodation. In evaluating the popularity of vodcast type, the Gram staining vodcast was the most frequently watched vodcast (by 70% of all viewers), followed by aseptic transfer (63%) and aseptic handling (62%). Gram staining and aseptic handling were the only 2 vodcasts watched more than 3 times, with 2 viewers reporting they watched each of them 5 times (see Figure 1).

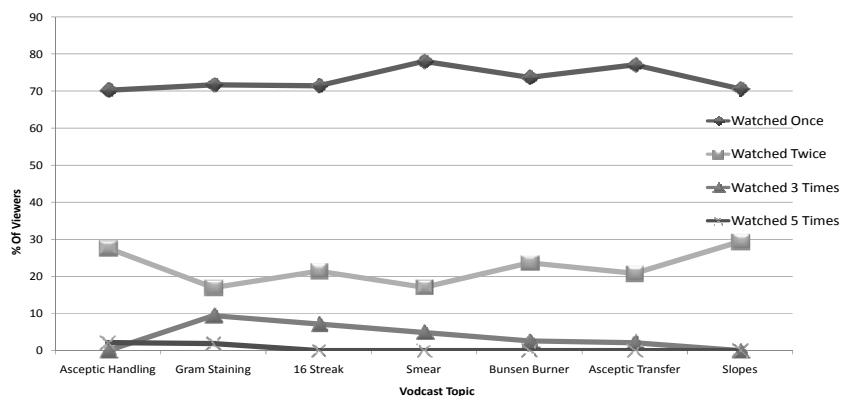


Figure 1. Proportion of viewers in relation to the number of times each vodcast was watched by an individual

Only one viewer considered the vodcast to be of 'no use' and only two considered them to be 'a waste of time'. The majority (75%) of viewers indicated they would like to see the technology used in other courses. In regards to skills and concepts, 22% of viewers thought that while the vodcasts were 'OK', they did not enhance their learning or skill development beyond what they would have achieved in practical classes or lectures alone. However, as shown in Figure 2, the majority of viewers thought the vodcasts did enhance their skill development and assisted their understanding of key concepts.

Discussion

A key objective of this study was to determine if students would access the non-traditional teaching tools made available to them and what their perceptions were regarding the merits of these tools for the teaching of microbial skills and concepts. Microbiology has long relied on the use of demonstrations to teach basic aseptic techniques in laboratory classes. Being able to effectively use online teaching tools, such as vodcasts, for this purpose holds great potential for enabling equality of instruction across educational delivery mode; all students, regardless of study mode or allocated laboratory class time, had access to expert instructions on demand by using this technology. The findings indicate most students find vodcasting to be a useful learning tool in addition to lectures and hands-on practical classes. Yet, such technologies remain supplemental as none of the students considered the vodcasts as possessing potential to replace practical classes; however all but one respondent felt that the vodcast had a place as a pre practical resources and or to reinforce what was demonstrated in the practicals. This caveat was echoed by Spanish pharmacy students learning

microbiology using a web-centred blended learning approach and resulted in students viewing web tools as complementary to standard lectures and practicals, not as replacements (Sancho et al. 2006).

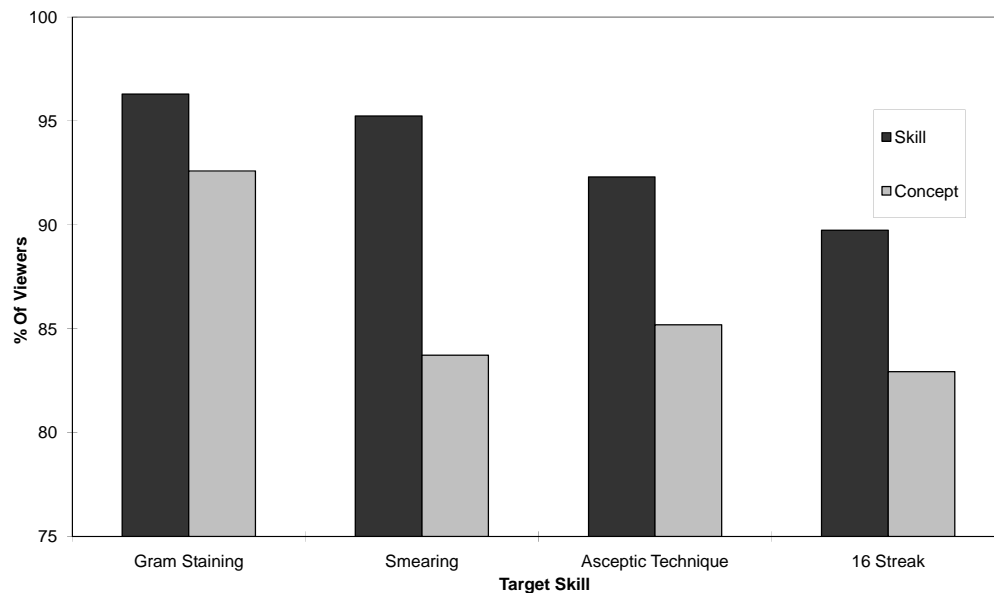


Figure 2. Perception of improved skill development and concept understanding as a result of vodcast viewing

The preference for the gram staining vodcast was expected as students were aware that their Gram staining skills were going to be examined. Student bias towards accessing assessment-related tools has led developers of course management software, such as *Blackboard*, to enhance integration of assessment options into the delivery modes offered (BizEd 2007). This move, which includes automated assessment, will not only enable instructors to identify the suitability of a tool as an education aid, but also will provide a means to identify what concepts students are struggling with during the semester. Such development will augment teachers' capacity to address learners' needs more accurately, especially for large classes with limited one-on-one opportunities. That students also chose to view tasks not directly associated with assessment items, yet essential to their development as microbiologists, was encouraging and indicates vodcasts may have a valuable role to play in the actual teaching of microbiology and not only in the revision of skills prior to an examination.

The high proportion (47%) of students accessing the learning materials via a non-CSU network was unexpected, especially since only three of the respondents were distance students without direct access to the CSU network. These results suggest moderate file sizes did not deter students from accessing the vodcasts and thus concerns about equity issues relating to technology access (Ragusa, 2007) may not be a significant factor for CSU students enrolled internally. Unfortunately, due to the low response rate for students enrolled in the distance mode, we are unable to draw conclusions about technology access issues for this cohort, some of whom may not have high speed internet access. However, if such an issue were identified, then the files could be provided on a CD to the affected students rather than being accessed as web-based vodcasts. It should be noted that CSU students are expected to have access to a reliable internet connection as CSU students have been accessing teaching resources online for several years and since 2008 have had access to *CSU Interact*, a *Sakai* based course management platform to obtain supplemental learning materials, lecture slides and communicate with other members of the class including educators.



Conclusion

This study has shown microbiology students consider vodcasting to be a useful tool to supplement their classroom and laboratory experiences. Location of viewing, the relation of content to assessment tasks and student age were shown to vary among users of vodcasts. Such findings lead us to recommend technology uptake can be enhanced through the linking of subject content to assessment items and by sending continuous reminders throughout the semester advising students to the existence of the vodcasts as many students simply remained unaware of them. Despite the potential cost issues, our findings show that the majority of students were willing to access supplemental learning resources using private networks despite the moderate file sizes inherent to the transmission of video data. Further studies are required to investigate the potential benefits of vodcasting, as determined by overall student performance in the subject, as well as assess the comparability of vodcasts among subjects, demographic divergences and the degree to which learning mode affects preference and adoption. Finally, it is clear that the students perceive that the vodcasts improve the development of skills and understanding, however whether their skills were actually improved by viewing the vodcasts cannot be adequately determined from this relatively small dataset. Although as educators, we feel that tools that provide students with an opportunity to engage multi-modes of learning are worth pursuing.

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